

New species of *Amphidromus* (*Syndromus*) from northern Meratus Mountains, Kalimantan

Jeff Parsons BAppSc, BSc (Hons)

47 Elizabeth Street, Aitkenvale, Queensland, Australia 4814

jeffonese@yahoo.com.au

ABSTRACT This paper describes a new member of the *Amphidromus* (*Syndromus*) *adamsii* (Reeve in Adams, 1848) group from Mount Sarempakang on the border of South and East Kalimantan, Indonesia. A comparison is made with other members of the *A. (S.) adamsii* group, and with extraterritorial species in the groups of *A. (S.) contrarius* (Müller, 1774) and *A. (S.) sinistralis* (Reeve, 1849). *A. (S.) stevenliei* new species is distinguishable from other members of the *A. (S.) adamsii* group based on shell and animal morphology, and conchologically separable from other congeners.

KEY WORDS *Amphidromus*, *Syndromus*, *stevenliei*, Mount Sarempakang, Borneo, Kalimantan.

INTRODUCTION Species belonging to the group of *Amphidromus* (*Syndromus*) *adamsii* (Reeve in Adams, 1848) have some of the most varied and brightly coloured shells of the whole genus *Amphidromus* Albers, 1850. Fulton first conceived the group in 1896 whilst naming variations of *A. (S.) adamsii*, and grouped them with similar established and new taxa from southern Palawan, islands of the Palawan Passage, Borneo and northern satellite islands. In 1900 whilst partially rearranging Fulton's groupings, Pilsbry modified the status of some taxa and added five species to the *A. (S.) adamsii* group. Laidlaw and Solem (1961) removed four of those species from the group and changed the status of the fifth and other taxa. Until more material becomes available for study, a modified version of what Laidlaw and Solem proposed is used, which includes one recently named species, *A. (S.) thalassochromus* (Vermueulen & Junau, 2007).

Mid 2014, Steven Lie sent me several photos of a live *Amphidromus* snail he received from his contacts in South Kalimantan and asked me to

identify it. This snail is from Mount Sarempakang, on the border of South and East Kalimantan ('Sarempaka' in fig. 1). A lack of published photos of living *Amphidromus* snails meant its identification had to wait until Steven sent me a photo of an empty shell. A study of Bornean *Amphidromus* found three other species with similar comet-like blotches on the lower whorls: *A. (S.) angulatus* (Fulton, 1896), *A. (S.) coeruleus* (Clench & Archer, 1932) and *A. (S.) thalassochromus*. Very small, degraded or reduced comet-like blotches, and similar periostracum and/or parietal tubercles are found on shells of *A. (S.) quadrasi* (Hidalgo, 1887) and its subspecies [*A. (S.) adamsii* group], and extraterritorial species in the groups of *A. (S.) contrarius* (Müller, 1774) and *A. (S.) sinistralis* (Reeve, 1849). However, those congeners are all conchologically separable from the new species. The Mount Sarempakang snail is distinguishable from other members of the *A. (S.) adamsii* group based on shell and animal morphology, and described herein as *A. (S.) stevenliei* new species.

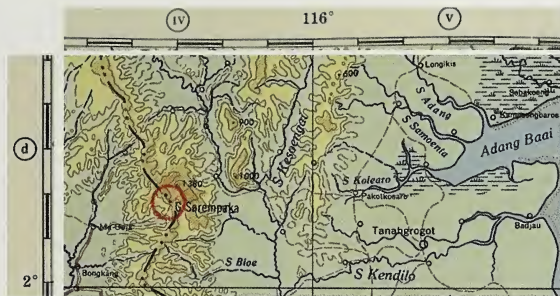


Figure 1. Location map for *Amphidromus (Syndromus) stevenliei* new species. The red circle indicates the approximate position of the type locality. Modified from a map of "Bandjermasin, Borneo" (University of Texas Libraries, 2015)

Materials and Methods

Type material has been deposited in the Natural History Museum, London, England, UK and Muséum National d'Histoire Naturelle, Paris, France; and additional types are found in the private collections of Steven Lie, John Abbas and the author. Preserved anatomical material was unavailable for study. Instead, a comparison was made of living animals of the new and related species using digital images from Steven Lie, Bornean Terrestrial Molluscs website (Liew, 2011) and anonymous sources. The species description was determined from shell morphology of dry empty shells supplied by Steven Lie and John Abbas. Comparative material comprised of shells from my own private collection and images of type shells published by Sutcharit *et al.* (2015).

Shells were measured using digital Vernier callipers (0.01 mm resolution). Shell height, aperture length and shell width include the reflected outer lip for adult shells. The parameter 'umbilical size' reflects a shell's umbilicus may be roundly open or rimate. Relative shell sizes for the subgenus *Syndromus*

mentioned are as follows: small < 30 mm, medium 30-45 mm and large > 45 mm. Whorl count includes the apex as per Haniel (1921, p. 22, fig. 10) and counted precise to 0.125 (¼ whorl). The aperture length was measured along the long axis as per Haniel (1921, p. 10, fig. 2). Shell weight was measured in grams (g) using a pocket-sized electronic scale (capacity 300 g x 0.01 g).

Shell sculpture was examined under low magnification (10x) using a jeweller's loupe. All but one of the shells examined had formed an outer lip: 15 adults (four damaged with the apex or protoconch missing, a dent or a hole) with a thickened lip, 3 subadults with broken thin lips and one brown juvenile without a lip. Colours are described as per the nomenclature of Ridgway (1912) or common English (Geddes & Grosset, 2007), and hyphenation follows that of the 'Style Manual' (U.S. Government Printing Office, 2008). 'Paries' (adj. parietal) refers to the 'inner apertural wall'. 'Palatum' (adj. palatal) refers to the interior surface of the labrum (outer lip) or 'outer apertural wall'.

Taxonomic remarks

According to Petit (2007), the correct "author and date" citation for *A. (S.) adamsii* is (Reeve in Adams, 1848). See Petit's work for his justification. I here accept *A. (S.) quadrasi dubius* (Fulton, 1896), *A. (S.) q. everetti* (Fulton, 1896), *A. (S.) q. solidus* (Fulton, 1896), *A. (S.) q. versicolor* (Fulton, 1896) and *A. (S.) q. palawanensis* (Bartsch, 1928) all as valid subspecies until confirmed otherwise. The *A. (S.) contrarius* group includes *A. (S.) contrarius*, *A. (S.) reflexilabris* (Schepman, 1892) and *A. (S.) laevis* (Müller, 1774) as per Severns (2006). The *A. (S.) sinistralis* group contains the species as stated by Laidlaw and Solem (1961).

Abbreviations used for museums and private collections:

NHMK = Natural History Museum, London, England, UK

MNHN = Muséum national d'Histoire naturelle, Paris, France

SL = Steven Lie collection

JA = John Abbas collection

JP = Jeff Parsons collection

Abbreviations for shell morphometry:

A = aperture length

A/H = aperture length/shell height ratio

D = shell width (the abbreviation aligns with the usage of 'diameter' in the literature)

H = shell height

H/D = shell height/shell width ratio

N = whorl count

W = shell weight

U = umbilical size

SYSTEMATIC DESCRIPTION

Class Gastropoda Cuvier, 1795

Family Camaenidae Pilsbry, 1895

Genus *Amphidromus* Albers, 1850

Subgenus *Syndromus* Pilsbry, 1900

***Amphidromus (Syndromus) stevenliei* new species
(Figures 2–5)**

Type Material: 12 adult shells (11 yellow and 1 flesh-coloured) and 1 juvenile (brown).

Holotype (Figure 2): NHMUK 20150004/1

Holotype measurements: H 38.00 mm, D 20.37 mm, H/D 1.87, A 19.06, A/H 0.50, N 6.50, U 0 mm and W 0.72 g

Paratypes (12 shells): NHMUK 20150004/2 (1 yellow shell); MNHN IM-2012-36212 (1 yellow shell); SL (1 yellow shell); JA (1 yellow shell); JP (8 shells - 6 yellow adults, including 2 damaged by a dent or a hole; 1 brown juvenile and 1 flesh-coloured adult)

Paratype measurements: H 31.35–38.04 (av. 34.68) mm, D 16.50–21.24 (av. 19.59) mm, H/D 1.63–2.01 (av. 1.77), A 14.98–19.08 (av. 17.39), A/H 0.48–0.54 (av. 0.50), N 6.25–6.875 (av. 6.50), U - (round) 0–0.89 (av. 0.43) mm, U - (rimate) 0.41 x 0.21 to 1.50 x 0.31 (av. 0.89 x 0.42) mm and W 0.59–1.60 (av. 0.91) g

Type locality: Mount Sarempakang, northern Meratus Mountains, border of South and East Kalimantan, Indonesia (Figure 1).

Distribution: currently known only from the type locality.

Habitat: found on the leaves and trunks of various small trees (about 2 m high) and bananas in mixed dipterocarp and submontane forest, collected by locals for Steven Lie.

Animal: body yellowish grey with a wide, blackish mid-dorsal stripe, all sprinkled with lemon granules, paler on the flanks; ocular and sensory tentacles yellowish grey at the base grading to pale orange-brown and yellow ochre respectively; foot and tail pale grey with paler granules; sole cream and mantle pale grey to very pale flesh-coloured (Figure 3).

Soft Parts: still under investigation.

Etymology: named in honour of Mr. Steven Lie from Sumatra, Indonesia, who is new to the hobby of snail collecting and the first person to bring this snail to my attention.

Other Material Examined: 6 yellow shells examined from the type locality (JP); 3 subadult shells with damaged very thin reflected lips and 3 damaged adult shells – apex missing in one, protoconch missing in another, plus one with depigmented areas and increased shell transparency.

Shell measurements (6 shells): H 29.13–40.00 (av. 32.47) mm, D 17.83–20.75 (av. 18.80) mm, H/D 1.63–1.68 (av. 1.66), A 15.16–18.56 (av. 16.85), A/H 0.46–0.54 (av. 0.51), N 6.125–7.00 (av. 6.50), U – (round) 0 mm (1 shell), U – (rimate) 0.57 x 0.26 to 1.13 x 0.42 (av. 0.75 x 0.26) mm and W 0.42–0.78 (av. 0.54) g.



Figure 2. *Amphidromus (Syndromus) stevenliei* n. sp., holotype NHMUK 20150004/1.

DESCRIPTION

Shell medium sized, sinistral, relatively solid and ovate-conic. Spire subturreted, moderately long. Surface rather shiny; *protoconch* minutely pitted (punctulate); *teleoconch* marked with collabral growth threads and lines, occasional ridgelets on the last two whorls and microthreads (crowded apically); plus spirally directed short ridgelets, grains and/or obsolete

striae. Whorls rather convex, gradually expanding; last whorl not inflated, not descending in front and base gently rounded; periphery obsoletely, subangularly rounded. Suture impressed apically, appressed below. Periostracum pale green-yellow.

Protoconch 1½ whorls, flesh tinted; rotund and subtranslucent. Apex blunt, barely exsert; subopaque, whitish. Transition to the teleoconch

distinguished by a change in sutural angle. Teleoconch pale flesh tinted grading to pale lemon, base darker. Early whorls have greyish streaks and an obsolescent, flesh-tinted supraparipheral band. Infracutural fillet cream apically, white below. Last three whorls with scattered, clustered or obliquely aligned comet-like blotches. Markings initiated by a subtransparent, grey spot (> 0.5 mm) or dot (< 0.5 mm), sometimes with a lemon subcentral speck; and attached to a faint, whitish adapertural streak. Spots and dots are round or oval, 0.1–0.8 mm wide or long; streaks slightly narrower, 1–2.75 mm long. Last whorl has a wide and obsolescent, purple basal band on the paries and a narrow and ghostly, greyish peripheral band, visible only in transmitted light. Circumbilical band pale magenta, narrow.

Aperture oblique, auriform. Palatum covered in a dull-lemon film, clearly showing the external markings. Parietal callus faintly calcified, colourless and imperceptible. Outer lip very glossy, vivid magenta, thickened and somewhat flared; edge flat, strongly reflected and narrowly expanded. Preapertural band pale greyish cream; lip termination slightly ascending. Outer lip may also be purplish magenta and fades to brownish pink after death. Columella glossy, vivid magenta, narrow and a little twisted; oblique and abaperturally angled ventrally; subvertical and proclined laterally; base slightly excurved. Columellar margin very narrowly tapered and curled upon itself at the base. Umbilicus closed.

Shell Variation/Remarks:

Shell shape is also ovate-pyramidal, ovate-conic or ovate-elongate with an obsoletely subangular to well-rounded periphery. Some shells have a



Figure 3. Live *A. (S.) stevenliei* n. sp. (Photo by Steven Lie)

tapered spire with slightly convex upper whorls grading to rather convex on the last, which is a little inflated to ventricose with a rounded base. Aperture shape may also be subauriform or semioval. The palatal callus may whiten with age or after death. The parietal callus erodes and/or whitens after death. The circumbilical band may also be dark magenta, purplish magenta or blackened, rarely diffuse on the paries and distinct outside, and sometimes very narrow. The columella is occasionally vertical or abaperturally angled only on the lower half, and sometimes darker than the lip. Apical whorls may have a wider pink band (apicosuperior fillet) below the infracutural fillet that forms an evanescent apical swirl as seen in apical view, sometimes joined to a same-coloured apex.

There are two colour forms, 'yellow' (pale lemon) and 'pinkish brown' (pale to dark, flesh to cacao brown) (fig. 4A). The periostracum is generally colourless below the suture and

sometimes above the circumumbilical band, showing the shell colour below, and commonly has darker collabral lines. The periostracum of yellow shells is rarely plain, pale straw yellow (Figure 4B), and when of a dull green-yellow hue it gives a greenish tint to the palatum. Pinkish-brown shells have a pinkish-cinnamon or olive-tinted periostracum. The streaks of the comet-like blotches are whitish below the periostracum and appear “less distinct” on yellow shells than on pinkish-brown shells, due to the lower contrast with the pale lemon ground. The holotype represents the average conchological and periostracal features of the more common yellow shells.

The protoconch of yellow shells is sometimes subopaque and yellowish grey, cream, whitish

or grey with a greyish or cream apex, rarely flesh tinted. The preapertural band may be brownish cream outside and white inside, or absent. Early teleoconch whorls are also buff, pale cream or grey tinted, and may have an obsolescent, grey suprapерipheral band and/or pinkish streaks. Lower whorls may have a few scattered darker lemon streaks. The last whorl occasionally has obsolescent dark coloured basal bands (Figure 4C) or ghostly, greyish markings: spiral lines or bands above the periphery and/or a wide and submedial band with slightly darker borders (Figure 4D). These ‘ghostly markings’ are best viewed using transmitted light, *i.e.* by holding a shell over a lamp. Very rarely a yellow shell may appear to lack the comet-like blotches (JP), with the markings reduced to subopaque, lemon dots that are imperceptible without magnification.



Figure 4. Shell colour, periostracum and pattern variation of *A. (S.) stevenliei* n. sp.: A pinkish-brown shell (paratype 11, JP); B yellow periostracum (paratype 9, JP); C dark obsolescent basal bands (paratype 10, JP); and D ghostly submedial band (paratype 5, JA).

Pinkish-brown shells have a pink or grey-brown protoconch. The infrasutural fillet is salmon, pale flesh or creamy, and wider apically. The preapertural band is pale magenta outside and whitish inside. Early teleoconch whorls are fawn, with or without markings as per yellow shells. Brown and red-brown streaks occasionally appear on the lower whorls. Only pinkish-brown shells have a rose or magenta subsutural band below a very thin, whitish infrasutural fillet. The apex of both colour forms is the same colour as either the protoconch ground or infrasutural fillet, or different to both as in the holotype.

A. (S.) stevenliei n. sp. may have parietal tubercles, generally poorly or weakly developed when present. Shells more commonly lack both tubercles than both being present. The parieto-columellar (P-C) tubercle is generally present in combination with the parieto-labral (P-L) tubercle and is rarely alone. The P-L tubercle is never present alone and develops from a very thin and tiny, colourless smudge of callus c. 0.5 mm long adjoined to the outer lip termination

(immature stage) (Figure 5A). With increased thickening it develops into a colourless tiny to small and thin to thickened, flat subtriangular lump c. 0.5-1.5 mm long (mature stage) (Figure 5B).

The P-C tubercle shows three stages of the development. It develops from a very thin, colourless smudge of callus c. 2 mm long beside the root of the columella (immature stage) (Figure 5C). A very slightly thickening from the margin inward, forms a thin lump (curved or not) c. 1-2 mm long, which is colourless, translucent whitish or magenta tinted as per columella (submature stage) (Figure 5D). Continued thickening from the base along the parietal callus margin forms a sickle-shaped (falcate) tubercle, which is wider at the base and thins toward the tip as a colourless, curved trace or line of callus (mature stage) (Figure 5E). Rarely there is a continuation of a trace thickening along the parietal margin connecting both tubercles. The circumumbilical band clearly shows through the P-C tubercle when it is immature and weakly so when submature.



Figure 5. Parietal tubercles of *A. (S.) stevenliei* n. sp. (letters close to each one). Parieto-labral (P-L) tubercle: A immature (paratype 2, MNHN IM-2012-36212); B mature (non-type shell, JP); Parieto-columellar (P-C) tubercle: C immature (paratype 2, MNHN IM-2012-36212); D submature (paratype 11, JP) and E mature (non-type shell, JP).

DISCUSSION

The animal of *A. (S.) stevenliei* n. sp. (Figure 3) differs from that of *A. (S.) thalassochromus*, which is a sooty-grey body with ivory or cream granules and a darker grey or blackish dorsal stripe, plus sooty-grey tentacles with orange-brown tips (images: anonymous). Assuming I have correctly identified a live animal of *A. (S.) angulatus* (Fulton, 1896), it also has a different animal coloration: walnut brown with pale smoke-grey granules, chestnut face and a wide, vinaceous-brown dorsal stripe, plus purplish-grey ocular tentacles and brownish-orange sensory tentacles (images: anonymous). No images of live animals of *A. (S.) coeruleus* could be found for comparison, only misidentified species from southern Sarawak that have closer ties to *A. (S.) adamsii* var. C of von Martens (1867).

A. (S.) quadrasi palawanensis (Bartsch, 1928) from Brook's Point, Palawan has a chestnut animal with vinaceous-pink granules, black head, ivory foot, grey tail and black tentacles with orange-brown tips (images: anonymous). The animals of *A. (S.) pictus* (Fulton, 1896) and *A. (S.) adamsi* var. *subunicolor* (Fulton, 1896) have contrasting body-foot coloration, and both easily separated from all other species formerly mentioned (images: Liew, 2011). *A. (S.) pictus* has a blackish-purple animal with mauve granules, deep vinaceous tentacles and an ivory foot. The animal of *A. (S.) adamsi* var. *subunicolor* is quite different, having a vinaceous-fawn body with pale pinkish-buff

granules, pale flesh tentacles and a purplish-grey foot.

The markings in *A. (S.) stevenliei* n. sp. are "comet-like" in the sense that the "spot/dot" is like the head of a comet, and the "streak" is the comet's tail. They are similar to what Clench and Archer (1932) described for *A. (S.) coeruleus*, which are smaller with a black dot and a small, yellowish triangular mark (Figure 6C). However, Laidlaw and Solem (1961) figured a specimen (Figure 16B, CNHM 72371 ex Laidlaw) from Baram River, not far from the type locality, and they described the markings as a small spot of intense blue at the posterior edge of an elongated yellow fleck (Figure 6D). That specimen differs from the type series in having numerous variable sized comet-like blotches like those of *A. (S.) stevenliei* n. sp., and the obsolescent or coalescent spire markings reach the last whorl.

A. (S.) angulatus has small, comet-like blotches with a blackish or dark brown dot and a short, creamy streak, more distinct on the chestnut interior (Figures 3H-I; Sutcharit *et al.*, 2015) (Figures 6A, 6B). Reduced comet-like blotches occur in *A. (S.) thalassochromus*, described by Vermueulen and Junau (2007) as a few tiny dark spots with a yellow halo scattered below the periphery, although some of these haloed dots occur above the periphery (images: anonymous). However, the holotype figure shows small comet-like blotches similar to those of *A. (S.) coeruleus* (Figure 9; Vermueulen and Junau, 2007) (Figure 6E).



Figure 6. Comet-like blotches: A, B *A. (S.) angulatus* (A, lectotype fig. 3H, and B paralectotype fig. 3I, Sutcharit *et al.*, 2015); C *A. (S.) coeruleus* (holotype, Clench & Archer, 1932); and D *A. (S.) thalassochromus* (holotype, Vermueulen & Junau, 2007). Degraded and reduced comet-like blotches: E degraded, *A. (S.) sinistralis* (lectotype fig. 14G, Sutcharit *et al.*, 2015); and F reduced, *A. (S.) quadrasi versicolor* (paralectotype fig. 15G; Sutcharit *et al.*, 2015).

Comet-like blotches are rarely very small and generally occur in a degraded or reduced form on shells of *A. (S.) quadrasi* and its subspecies, and species in the groups of *A. (S.) contrarius* and *A. (S.) sinistralis*. The degraded markings consist of a dot connected to a same-coloured adapertural line, and both are commonly translucent grey, but also brown or black. This line can be thin to thick and short to long, and sometimes separated from the dot by a small gap. The more common reduced markings are simple dots of the same colour (grey, brown or black), sometimes with a creamy halo.

The ghostly submedial band of *A. (S.) steveniei* n. sp. with its slightly darker borders is a decoloured version of that seen in *A. (S.) contrarius*: narrow yellow band between or bordered by black bands. *A. (S.) quadrasi* subspecies have dark bands bordering a yellow

band that is complete, obsolescent or absent, or all three bands absent. *A. (S.) coeruleus* lacks all three bands (Figures 7C, 7D). Some colour forms and subspecies of *A. (S.) adamsii* have a narrow, yellow submedial band, sometimes bordered by dark bands. *A. (S.) angulatus* has a narrow to wide, whitish or pale yellow submedial band bordered by chestnut or purple bands (Figures 7A, 7B). *A. (S.) thalassochromus* (Figure 7E) only has a thin, dark green or purplish submedial band, and sometimes has a same-coloured thin supermedial band above the periphery, which is yellow and narrow on *A. (S.) contrarius* and *A. (S.) adamsii*. This band is wider and uncoloured for *A. (S.) quadrasi* subspecies, and absent in *A. (S.) steveniei* n. sp., *A. (S.) angulatus* and *A. (S.) coeruleus*. *A. (S.) q. everetti* also commonly has a pale lemon or creamy preapertural band that appears white inside, and absent in the other species.

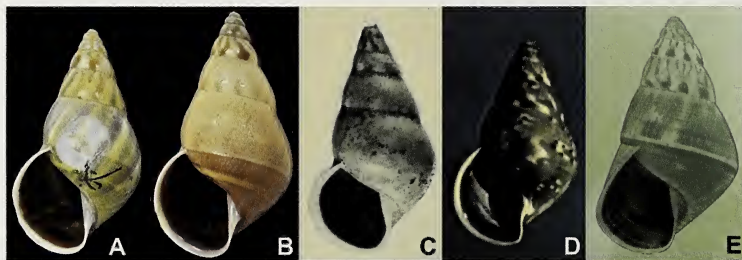


Figure 7. Nearest relatives of *A. (S.) steveniei* n. sp.: A, B *A. (S.) angulatus* (A lectotype fig. 3H; H 35.1 mm and B paralectotype fig. 3I; Sutcharit *et al.*, 2015); C *A. (S.) coeruleus* (holotype, H 44.5 mm, Clench & Archer, 1932); D *A. (S.) coeruleus* (Laidlaw & Solem, 1961); and E *A. (S.) thalassochromus* (holotype, H 32 mm, Vermueulen & Junau, 2007).

Even at full maturity, the parietal tubercles of *A. (S.) stevenliei* n. sp. are less developed than mature parietal tubercles of *A. (S.) laevis Janettabasae* (Parsons, 2014). A mature P-L tubercle is flatter and lacks a gap or groove separating it from the lip like that of *A. (S.) contrarius*. A similar P-L tubercle is found in *A. (S.) laevis Janettabasae*, *A. (S.) maculatus* (Fulton, 1896), *A. (S.) sinistralis*, *A. (S.) q. quadrasi*, *A. (S.) q. dubius*, *A. (S.) q. everetti*, *A. (S.) q. solidus* and *A. (S.) q. versicolor*. The same type of falcate P-C tubercle formation occurs in *A. (S.) beccarii* (Tapparone-Canefri, 1883), *A. (S.) q. quadrasi*, *A. (S.) q. everetti* and *A. (S.) q. versicolor*. However, the falcate P-C tubercle of *A. (S.) laevis Janettabasae* has the margin thickened before the base. This also occurs in *A. (S.) beccarii*, *A. (S.) q. dubius*, *A. (S.) q. everetti*, *A. (S.) q. solidus* and *A. (S.) q. versicolor*. In contrast, *A. (S.) q. everetti* and *A. (S.) q. versicolor* may instead develop a curved or straightened ridge, like a flatter version of that in *A. (S.) kuehni* (von Moellendorff, 1902).

Ignoring tonal or colour variation, many species of the *A. (S.) adamsii* group display a single type of periostracal coloration. However, some species are like *A. (S.) stevenliei* n. sp. and have two types, and a few others have three or even four types. A superscript number following a species name indicates the number of periostracal types that species displays. Periostracum is plain, buff or pale tawny in *A. (S.) adamsii*, *A. (S.) hamatus* (Fulton, 1896), *A. (S.) angulatus*², *A. (S.) q. quadrasi*³, *A. (S.) q. dubius*, *A. (S.) q. everetti*² and *A. (S.) q. versicolor*⁴. Viridine-yellow periostracum with lettuce-green collabral lines occurs in *A. (S.) q. quadrasi*³, *A. (S.) q. solidus*, *A. (S.) q. versicolor*⁴ and *A. (S.) angulatus*². The periostracum of *A. (S.) q. quadrasi*³ may also be pale buff with darker collabral lines and that of *A. (S.) q. everetti*² olive buff with deep olive collabral lines. *A. (S.) q. versicolor*⁴ may also

have a primrose-yellow periostracum that has a plain, dark greenish-olive wedge behind the lip, or a viridine-yellow wedge with darker lines.

Adult shells of *A. (S.) stevenliei* n. sp. display variability in angularity or roundness of the periphery. This contrasts with its closest relatives where the periphery is: rounded for *A. (S.) coeruleus*, obsoletely subangular on *A. (S.) angulatus* and obtusely angular on *A. (S.) thalassochromus*. *A. (S.) stevenliei* n. sp. is easily separated from those three species by shell and animal coloration, although most similar in pattern to *A. (S.) coeruleus*. Those three species have a white lip and columella contrasting with vivid magenta in *A. (S.) stevenliei* n. sp., yet all four species have a similar appearance in the lip, columella, aperture shape and umbilicus.

The upper whorls of *A. (S.) stevenliei* n. sp. are quite variable in colour; commonly with an evanescent, pink apicosuperior fillet on the protoconch and grey or pinkish streaks early on the teleoconch. The apex is whitish, greyish, cream or rarely pink, but never dark coloured. Whereas, the upper whorls of *A. (S.) angulatus*, *A. (S.) coeruleus* and *A. (S.) thalassochromus* are whitish, creamy or brownish with brown stripes or flammules, which are forked above or not. These markings change colour mid-spire: bluish grey or purplish grey for *A. (S.) angulatus*, dark bluish grey for *A. (S.) coeruleus*; and yellowish green, bluish purple or brownish purple for *A. (S.) thalassochromus*. The stripes remain brown only in *A. (S.) angulatus*.

All three congeners show a change in ground colour through modification of pattern on the lower whorls. A paler suffusion appears in the interspaces of the markings, which become obsolete or coalesce on or before the last whorl. Streaks or flecks of original ground colour appear randomly on *A. (S.) coeruleus* and

sometimes form the interspaces of a supraprimerial spot-band on *A. (S.) thalassochromus*. Both of these species tend to have a paler and greyed superior zone below the suture. In *A. (S.) adamsii*, this superior zone is a paler hue, whitish or bluish grey depending on the colour form. In contrast, *A. (S.) stevenliei* n. sp. does not have the ground colour change by pattern modification, although the base is darker. The base is also darker in *A. (S.) angulatus* and in *A. (S.) thalassochromus*, and both have a narrow, yellow submedial band, which is absent in *A. (S.) stevenliei* n. sp. and *A. (S.) coeruleus*.

In summary, *A. (S.) coeruleus* has a similar primary pattern on lower whorls, but differs from *A. (S.) stevenliei* n. sp. in having a bluish-grey ground created by suffusion of stripe pigment on the spire. *A. (S.) stevenliei* n. sp. is easily separated from *A. (S.) angulatus* and *A. (S.) thalassochromus* by a different primary pattern on lower whorls of comet-like blotches on a pale lemon or pinkish-brown ground, and by differences in animal coloration. In *A. (S.) coeruleus*, *A. (S.) angulatus* and *A. (S.) thalassochromus* the lip and columella are white and the interior is dark livid purple to slate grey. For *A. (S.) stevenliei* n. sp. the lip and columella are glossy, vivid magenta and the interior is lemon yellow.

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REFERENCES

- Clench, W.J. and A.F. Archer. 1932. Some new land molluscs from Borneo and the Philippines, *Occasional papers of the Boston Society of Natural History* 8: 37-42; *Amphidromus coeruleus* pp. 41 & 42, pl. 4, figs. E and F.
- Fulton, H. 1896. A List of the Species of *Amphidromus*, Albers, with Critical Notes and Descriptions of some hitherto undescribed Species and Varieties, *The Annals and Magazine of Natural History*, (sixth series) 17: 66-94, Plates V-VII.
- Geddes, D. and R. Grosset. 2007. *English Dictionary and Thesaurus* with IPA, includes full colour world atlas, Geddes and Grosset, New Lanark: 1024 pp; ISBN 9781842056004.
- Haniel, C.B. 1921. Variationsstudie an Timoresischen Amphidromusarten, *Zeitschrift für induktive Abstammungs- und Vererbungslehre*, Bd. 25 (Heft 1-2): 88 pp. (Mit 5 Tafeln, 27 Textfiguren, 5 Tabellen und einem Anhang mit den Schalenmaßen).
- Laidlaw, F.F. and A. Solem. 1961. The land snail genus *Amphidromus*: A synoptic catalogue, Edited by LA Ross, *Fieldiana: Zoology* 41 (4): 503-677, 26 Text Figures.
- Liew, T.S. 2011. *Bornean Terrestrial Molluscs*. Available at: <http://borneanlandsnails.myspecies.info> [Accessed: 18 January 2011, originally as <http://borneanlandsnails.lifedesks.org>]
- von Martens, E. 1867. *Die Landschnecken*, Zoologischer Theil, Zweiter Band, *Die Preussische expedition nach Ost-Asien: nach amtlichen quellen*, Verlag der Königlichen Geheimen Ober-Hofbuchdruckerei, Berlin, (R. v. Decker), 447 pp. (mit XXII Illustrationen). *Bulimus adamsii* p. 336; *Bulimus adamsi* pp. 356-357; and *Bulimus adamsi* (not this species) p. 446, pl. 31, figs. 11, 12.

- Petit, R.E. 2007.** Lovell Augustus Reeve (1814–1865): malacological author and publisher, *Zootaxa* 1648: 1–120, ISBN 978-1-86977-172-0 (online ed.). Retrieved from <http://www.vliz.be/imisdocs/publications/130389.pdf> [Accessed: 9 April 2015]
- Pilsbry, H.A. 1900.** *Australasian Bulimulidae: Bothriembryon, Placostylus, Helicidae: Amphidromus*, Vol. XIII, *Manual of Conchology, Structural and Systematic, with Illustrations of the Species*, Second Series Pulmonata, Conchological Section, Academy of Natural Sciences of Philadelphia, Philadelphia. *Amphidromus*: pp. 127–234, pl. 46–71.
- Ridgway, R. 1912.** *Color standards and color nomenclature*, Ridgway, Washington DC; 44 pp and 53 coloured plates with 1150 named colours.
- Severns, M. 2006.** A new species and a new subspecies of *Amphidromus* from Atauro Island, East Timor (Gastropoda, Pulmonata, Camaenidae), *Basteria* 70: 23–28.
- Sutcharit, C., J. Ablett, P. Tongkerd, F. Naggs and S. Panha. 2015.** Illustrated type catalogue of *Amphidromus* Albers, 1850 in the Natural History Museum, London, and descriptions of two new species, *ZooKeys* 492: 49–105, doi: 10.3897/zookeys.492.8641
- University of Texas Libraries 2015.** Perry-Castañeda Library Map Collection, Indonesia AMS Topographic Maps, *Bandjermasin, Borneo*, SA 50, First Edition AMS 3, East Indies 1:1,000,000, U.S. Army Map Service, 1944. Available at: <http://www.lib.utexas.edu/maps/imw/txu-pclmaps-oclc-6599452-bandjermasin-sa-50.jpg> [Accessed: 5 Feb 2015]
- Vermueulen, J.J. and D.J. Junau. 2007.** Bukit Sarang (Sarawak, Malaysia), and isolated limestone hill with an extraordinary snail fauna, *Basteria* 71 (4–6): 209–220; *Amphidromus thalassochromus* pp. 217 & 219, fig. 9.

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